

**PCT**WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>C07H 21/00, C12Q 1/68</b> <b>C07H 23/00</b>	<b>A3</b>	<b>(11) International Publication Number:</b> <b>WO 98/20162</b> <b>(43) International Publication Date:</b> 14 May 1998 (14.05.98)																					
<b>(21) International Application Number:</b> PCT/US97/20014 <b>(22) International Filing Date:</b> 5 November 1997 (05.11.97)  <b>(30) Priority Data:</b> <table border="0"><tr><td>08/743,798</td><td>5 November 1996 (05.11.96)</td><td>US</td></tr><tr><td>60/040,155</td><td>7 March 1997 (07.03.97)</td><td>US</td></tr><tr><td>08/873,597</td><td>12 June 1997 (12.06.97)</td><td>US</td></tr><tr><td>08/873,978</td><td>12 June 1997 (12.06.97)</td><td>US</td></tr><tr><td>08/899,510</td><td>24 July 1997 (24.07.97)</td><td>US</td></tr><tr><td>08/911,085</td><td>14 August 1997 (14.08.97)</td><td>US</td></tr><tr><td>08/911,589</td><td>14 August 1997 (14.08.97)</td><td>US</td></tr></table> <b>(71) Applicant (for all designated States except US):</b> CLINICAL MICRO SENSORS [US/US]; 101 Waverly Drive, Pasadena, CA 91105 (US).  <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> KAYYEM, Jon, F. [US/US]; 428 South Sierra Bonita Avenue, Pasadena, CA 91106 (US). O'CONNOR, Stephen, D. [US/US]; 4222 South El Molino #16, Pasadena, CA 91106 (US). GOZIN, Michael [IL/US]; 276 South El Molino #33, Pasadena, CA 91101 (US). YU, Changjun [CN/US]; 400 Raymondale Drive #32, Pasadena, CA 91030 (US).		08/743,798	5 November 1996 (05.11.96)	US	60/040,155	7 March 1997 (07.03.97)	US	08/873,597	12 June 1997 (12.06.97)	US	08/873,978	12 June 1997 (12.06.97)	US	08/899,510	24 July 1997 (24.07.97)	US	08/911,085	14 August 1997 (14.08.97)	US	08/911,589	14 August 1997 (14.08.97)	US	<b>(74) Agents:</b> SILVA, Robin, M. et al.; Flehr, Hohbach, Test, Albritton & Herbert LLP, Suite 3400, 4 Embarcadero Center, San Francisco, CA 94111-4187 (US).  <b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>  <b>(88) Date of publication of the international search report:</b> 12 November 1998 (12.11.98)
08/743,798	5 November 1996 (05.11.96)	US																					
60/040,155	7 March 1997 (07.03.97)	US																					
08/873,597	12 June 1997 (12.06.97)	US																					
08/873,978	12 June 1997 (12.06.97)	US																					
08/899,510	24 July 1997 (24.07.97)	US																					
08/911,085	14 August 1997 (14.08.97)	US																					
08/911,589	14 August 1997 (14.08.97)	US																					
<b>(54) Title:</b> ELECTRODES LINKED VIA CONDUCTIVE OLIGOMERS TO NUCLEIC ACIDS  <b>(57) Abstract</b> <p>The invention relates to nucleic acids covalently coupled to electrodes via conductive oligomers. More particularly, the invention is directed to the site-selective modification of nucleic acids with electron transfer moieties and electrodes to produce a new class of biomaterials, and to methods of making and using them.</p>																							

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/20014

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C07H21/00 C12Q1/68 C07H23/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C07H C12Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 95 15971 A (CALIFORNIA INST OF TECHN) 15 June 1995 cited in the application see claims 1-20; figures 1-4; examples 1-7 ---	1-29
Y	R.P.HSUNG ET AL.: "Synthesis and Characterization of Unsymmetric Ferrocene-Terminated Phenylethynyl Oligomers." ORGANOMETALLICS, vol. 14, no. 10, 1995, pages 4808-4815, XP002077968 cited in the application see the whole document ---	1-29
Y	WO 93 10267 A (IGEN INC) 27 May 1993 see abstract; claim 1 ---	1-29
	--- -/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "3" document member of the same patent family

Date of the actual completion of the international search

18 September 1998

Date of mailing of the international search report

01/10/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040. Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Scott, J

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 97/20014

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category <sup>2</sup>	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 90 05732 A (THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK) 31 May 1990 see the whole document ---	1-29
Y	WO 94 22889 A (CIS BIO INT ;TEOULE ROBERT (FR); ROGET ANDRE (FR); LIVACHE THIERRY) 13 October 1994 see abstract; claims 13-18; examples 6-8 ---	1-29
Y	TURRO N J ET AL: "PHOTOELECTRON TRANSFER BETWEEN MOLECULES ADSORBED IN RESTICTED SPACES" PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON PHOTOCHEMICAL CONVERSION AND STORAGE OF SOLAR ENERGY, 1990, pages 121-139, XP002041921 see the whole document ---	1-29
Y	MURPHY C J ET AL: "LONG-RANGE PHOTOINDUCED ELECTRON TRANSFER THROUGH A DNA HELIX" SCIENCE, vol. 262, 12 November 1993, pages 1025-1029, XP002041920 see the whole document ---	1-29
A	AIZAWA M ET AL: "INTEGRATED MOLECULAR SYSTEMS FOR BIOSENSORS*" SENSORS AND ACTUATORS B, vol. B24, no. 1/03, PART 01, March 1995, pages 1-5, XP000521315 see abstract ---	1,9
A	J.R.REIMERS ET AL.: "Towards Efficient Molecular Wires and Switches : The Brooker Ions." BIOSYSTEMS, vol. 35, 1995, pages 107-111, XP002077969 see the whole document ---	1,2,9
P,Y	WO 96 40712 A (CALIFORNIA INST OF TECHN) 19 December 1996 see claims 1-27; examples 1-8 ---	1-29
P,Y	W.M.ALBERS ET AL.: "Design of Novel Molecular Wires for Realizing Long-Distance Electron Transfer." BIOCHEMISTRY AND BIOENERGETICS, vol. 42, 1997, page 25-33 XP002077970 see the whole document ---	1-29
P,Y	US 5 591 578 A (T.J.MEADE ET AL.) 7 January 1997 see the whole document ---	1-29
	-/--	

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 97/20014

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
T	<p>P.LINCOLN ET AL.: "Short-Circuiting the Molecular Wire."  JOURNAL OF THE AMERICAN CHEMICAL SOCIETY.,  vol. 119, no. 6, 1997, pages 1454-1455,  XP002077971  DC US  see the whole document  -----</p>	1,9

# INTERNATIONAL SEARCH REPORT

Information on patent family members

Int: lional Application No

PCT/US 97/20014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9515971 A	15-06-1995	US 5591578 A AU 1215295 A CA 2178618 A EP 0733058 A JP 9506510 T US 5770369 A US 5780234 A US 5705348 A	07-01-1997 27-06-1995 15-06-1995 25-09-1996 30-06-1997 23-06-1998 14-07-1998 06-01-1998
WO 9310267 A	27-05-1993	AU 658962 B AU 3141293 A CA 2100159 A EP 0567635 A IL 103754 A JP 2788786 B JP 6507316 T US 5635347 A ZA 9208839 A	04-05-1995 15-06-1993 16-05-1993 03-11-1993 15-04-1997 20-08-1998 25-08-1994 03-06-1997 13-05-1993
WO 9005732 A	31-05-1990	US 5112974 A AU 4647689 A CA 2002380 A US 5439794 A	12-05-1992 12-06-1990 07-05-1990 08-08-1995
WO 9422889 A	13-10-1994	FR 2703359 A AT 159028 T DE 69406119 D DE 69406119 T DK 691978 T EP 0691978 A ES 2110228 T GR 3025738 T JP 8508311 T	07-10-1994 15-10-1997 13-11-1997 26-03-1998 25-05-1998 17-01-1996 01-02-1998 31-03-1998 03-09-1996
WO 9640712 A	19-12-1996	AU 6166296 A US 5770369 A	30-12-1996 23-06-1998
US 5591578 A	07-01-1997	AU 1215295 A CA 2178618 A EP 0733058 A	27-06-1995 15-06-1995 25-09-1996

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 97/20014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5591578 A		JP 9506510 T	30-06-1997
		WO 9515971 A	15-06-1995
		US 5770369 A	23-06-1998
		US 5780234 A	14-07-1998
		US 5705348 A	06-01-1998
<hr/>			

**THIS PAGE BLANK (USPTO)**